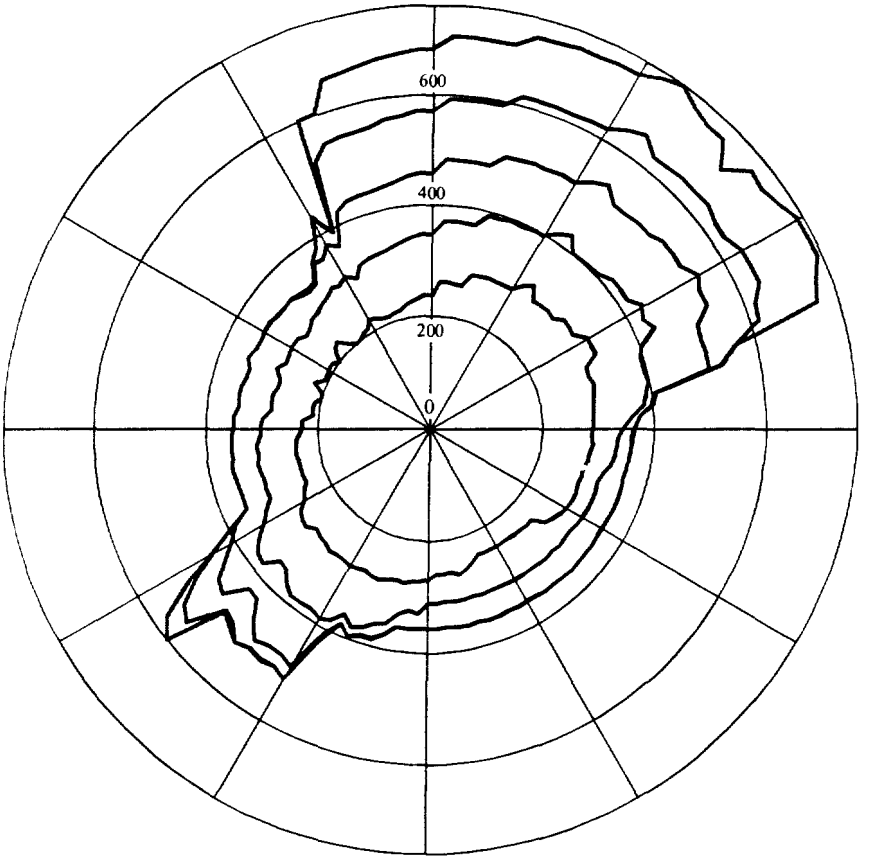
FIGURE 6-1

Propagation mode (1) main contour and auxiliary contours



The propagation mode (1) auxiliary contours are shown for –10, –20, –30 and –40 dB adjustements in the minimum require loss.

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3.2 Auxiliary contours for propagation mode (2)

The propagation mode (2) contour around an earth station is calculated assuming the main beams of the coordinating earth station and the terrestrial station intersect exactly (see § 1.3 of the main body of this Appendix). However, it is unlikely that these antenna main beams will intersect exactly. It is therefore possible to generate propagation mode (2) auxiliary contours that take account of any offset in the pointing of the terrestrial station antenna beam from the direction of the coordinating earth station. This offset would result in partial beam intersections and hence a reduced interference potential. These propagation mode (2) auxiliary contours are calculated according to the method described in § 3.2.1 of this Annex.

Propagation mode (2) auxiliary contours are not generated for different values of antenna gain or e.i.r.p. but for different values of beam avoidance angle. Hence, if there is a need to consider both a lower value of antenna gain, or e.i.r.p., for the terrestrial station and propagation mode (2) auxiliary contours, it is first essential to consider the impact of the reduction in antenna gain, or e.i.r.p., on the propagation mode (2) contour. This is achieved by generating a supplementary contour (see § 2) corresponding to the lower value of antenna gain or e.i.r.p. for the terrestrial station, which is drawn on a separate map. Auxiliary mode (2) contours can then be generated inside this propagation mode (2) supplementary contour for different values of the beam avoidance angle. Hence, propagation mode (2) auxiliary contours may be most frequently applied in conjunction with a supplementary contour rather than with the coordination contour.

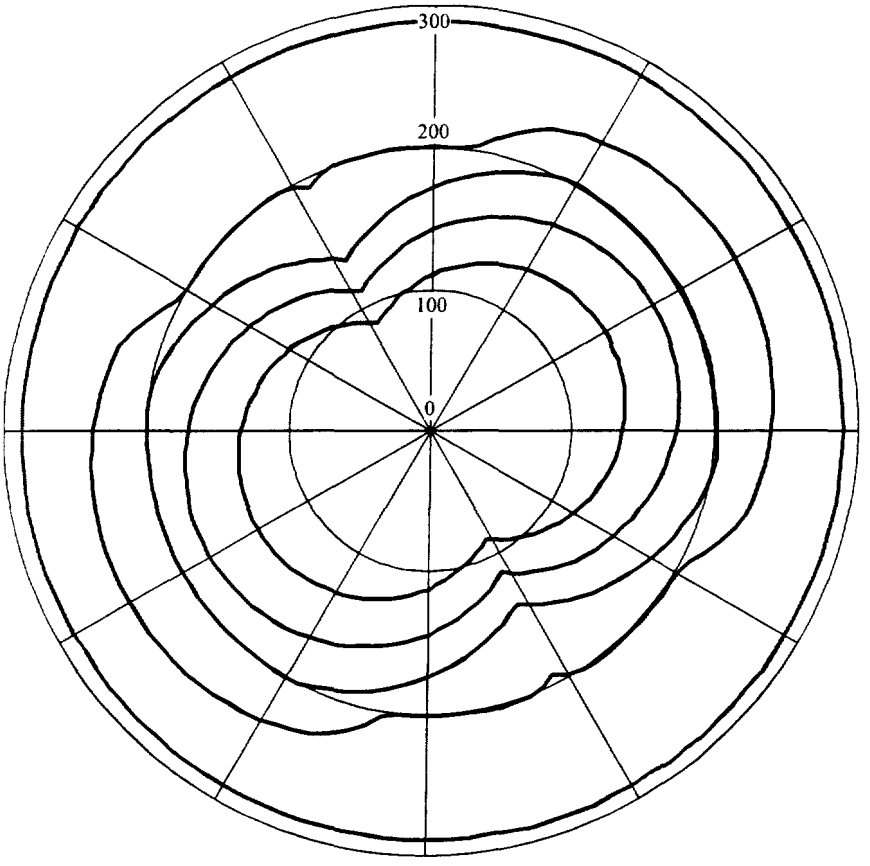
The correction factor discussed in § 1.3 of the main body of this Appendix does not apply to propagation mode (2) interference paths and hence is also not applicable to propagation mode (2) auxiliary contours. In addition propagation mode (2) auxiliary contours cannot be developed for the bidirectional case.

Propagation mode (2) auxiliary contours are prepared for appropriate values of terrestrial station main beam avoidance angle (see Figure 6-2). When the antenna characteristics of the terrestrial stations are known, the appropriate antenna pattern[9] should be used when determining the propagation mode (2) auxiliary contours. If this not available, the reference antenna pattern given in § 3.2.3 may be used.

[9] The method requires the antenna pattern to be monotonic in terms of the reduction in gain either side of the main beam axis.

FIGURE 6-2

Propagation mode (2) main contour and auxiliary contours



The propagation mode (2) auxiliary contours are shown for terrestrial station main beam avoidance angles of 2.0°, 2.7°, 3.2° and 4.0°, respectively

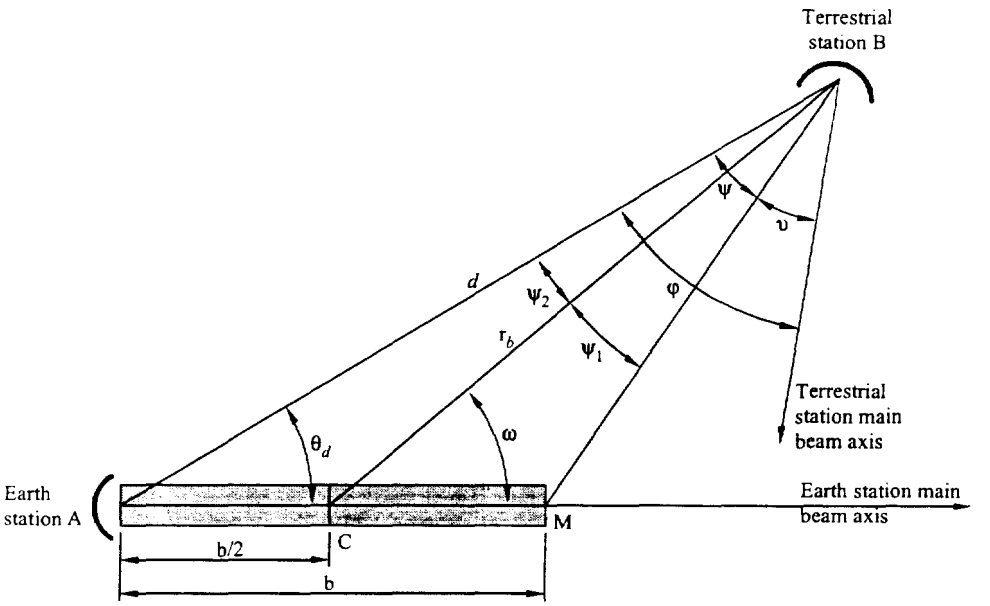
CMR2000/396-062

3.2.1 Determination of auxiliary contours for propagation mode (2)

Propagation mode (2) auxiliary contours allow the azimuthal offset of a terrestrial station antenna beam from the coordinating earth station's location to be taken into consideration. Figure 6-3 shows the hydrometeor scatter region projected on to the horizontal plane. In this figure, the earth station and the terrestrial station are located at the points A and B, respectively, where the terrestrial station is on a radial defined by the angle ω from the point C at the centre of the propagation mode (2) main, or supplementary, contour. Point C is also the centre of the auxiliary contour.

FIGURE 6-3

Propagation geometry in the horizontal plane



The shaded area in Figure 6-3 represents the critical region, along the earth station's main beam axis, between the earth station and the rain height. Within this critical region a common volume can be formed between the earth station beam and the beam of any terrestrial stations within the propagation mode (2) main, or supplementary, contour. This critical region's length is b and its maximum horizontal extent is at point M. Intersection of this critical region by the terrestrial station main beam axis would result in significant hydrometeor scatter interference via main lobe-to-main lobe coupling.

For a given point within the propagation mode (2) main, or supplementary, contour, the angle subtended by the critical region is termed the critical angle, ψ. The protection angle, υ, represents the angle of the terrestrial station main beam axis away from the critical region. The beam avoidance angle between the terrestrial station's main beam axis and the earth station's location is φ. It is the sum of the two angles ψ and υ and it is this quantity that has a fixed value for a specific auxiliary contour. Each auxiliary contour is generated by varying the angle, ω and deriving the distance (r_b) from point C to the auxiliary contour. As the angle ω increases from 0° to 360°, the angles ψ and υ change, but their sum remains the same.

The algorithm in § 3.2.2 of this Annex can be used to calculate the auxiliary propagation mode (2) contour for a given value of beam avoidance angle φ.

The method is based on iteratively decrementing the distance, r_b, between terrestrial station and the centre of the common volume, and starting at the main contour distance d_r, until either the shortest value of r_b is found for which the required minimum loss is achieved, or the minimum coordination distance is reached. For each value of r_b, the critical angle ψ is determined and then the protection angle υ is calculated. The terrestrial station antenna gain corresponding to υ and the current distance r_b are used to obtain the propagation mode (2) path loss in equation (2-21) in Annex 2.

The above process is repeated for each angle ω, to generate a complete auxiliary contour for a given value of beam avoidance angle φ. For some combinations of beam avoidance angle and angle ω, an auxiliary contour may coincide with the main, or supplementary, propagation mode (2) contour.

3.2.2 The step-by-step algorithm

Auxiliary propagation mode (2) contours are constructed by calculating distances along radials from the centre of the circular mode (2) main, or supplementary, contour, which is the point C, at the distance b/2 from the earth station along the azimuth of its main beam axis. The distance b/2 is equal to Δd, where Δd is given by equation (2-23) in Annex 2.

For the selected value of beam avoidance angle,φ, generate the auxiliary contour for values of angle, ω, ranging from 0° to 180° in steps of 1°, as follows:

a) Set r_b to the main, or supplementary, mode (2) contour distance d_r calculated as described in § 3.1 of Annex 2.

b) Compute ψ from:

$$\psi_1 = \arctan\left(\frac{b\sin\omega}{2r_b - b\cos\omega}\right) \quad (6\text{-}1)$$

$$\psi_2 = \arctan\left(\frac{b\sin\omega}{2r_b + b\cos\omega}\right) \quad (6\text{-}2)$$

$$\psi = \psi_1 + \psi_2 \quad (6\text{-}3)$$

c) If $\psi > \varphi$ then the auxiliary mode (2) contour coincides with the main or supplementary mode (2) contour for the current value of ω, and the calculation for that value of ω is completed, and go to step j). Otherwise proceed through the following steps d) to i) until one of the terminating conditions described in step f) and step i) is satisfied.

d) Decrement r_b by subtracting 0.2 km from its value.

e) Recalculate the critical angle ψ using equations (6-1), (6-2) and (6-3).

f) If $(0.5\ b \sin\omega/\sin\psi_2) < d_{min}$, the auxiliary mode (2) contour coincides with the minimum coordination distance d_{min} and the calculation for the current value of ω is completed - go to step j). Otherwise, proceed to step g).

g) Compute the protection angle $\upsilon = \varphi - \psi$.

h) Calculate $G(\upsilon)$, the terrestrial station antenna gain at the angle υ relative to the beam axis, using the reference antenna pattern given in this Annex.

i) In equation (2-21) in Annex 2, use the gain calculated in step h) in place of G_x and the value considered of r_b in place of r_i, and calculate the corresponding propagation mode (2) path loss L_r. If $L_r < L(p)$, then increment r_b by adding 0.2 km to its value and take this as the distance for the current radial. Otherwise, repeat from step d).

j) Once the value of r_b has been found for the current value of angle ω, calculate the angle θ_d from the location of the earth station, and if appropriate the distance, d, to that contour point using:

$$d = 0.5\, b \sin\omega / \sin\psi_2 \tag{6-4}$$

$$\theta_d = \omega - \psi_2 \tag{6-5}$$

An auxiliary propagation mode (2) contour is symmetrical about the earth station main beam axis. Thus, values of d and θ_d corresponding to the values of ω from 181° to 359° can be found by noting that results for a given value of ω are the same as for $(-\omega)$ or $(360°-\omega)$.

The step size for incrementing r_b used above, 0.2 km, is suitable for most situations. It controls the granularity of the result when viewed as a set of r_b values. For low values of earth station beam elevation, the granularity becomes more noticeable in the values of d and θ_d, and a smaller step size may be used.

3.2.3 Reference radiation patterns for line-of-sight radio-relay system antennas

The reference radiation pattern for line-of-sight radio-relay system antennas in this section is used for the unknown terrestrial station antenna in the propagation mode (2) auxiliary contour calculations when the actual antenna pattern is not available.

a) In cases where the ratio between the antenna diameter and the wavelength is greater than 100, the following equation is used:

$$G(\varphi) = G_{a\max} - 2.5\times10^{-3}\left(\frac{D}{\lambda}\varphi\right) \quad \text{for} \quad 0 < \varphi < \varphi_m \tag{6-6}$$

$$G(\varphi) = G_1 \quad \text{for} \quad \varphi_m \le \varphi < \varphi_r \tag{6-7}$$

$$G(\varphi) = 32 - 25\log\varphi \quad \text{for} \quad \varphi_r \le \varphi < 48° \tag{6-8}$$

$$G(\varphi) = -10 \quad \text{for} \quad 48° \le \varphi \le 180° \tag{6-9}$$

$$G_1 = 2 + 15\log\frac{D}{\lambda} \tag{6-10}$$

$$\varphi_m = \frac{20\lambda}{D}\sqrt{G_{a\max} - G_1} \tag{6-11}$$

$$\varphi_r = 15.85\left(\frac{D}{\lambda}\right)^{-0.6} \tag{6-12}$$

b) In cases where the ratio between the antenna diameter and the wavelength is less than or equal to 100, the following equation is used:

$$G(\varphi)=G_{a\max}-2.5\times10^{-3}\left(\frac{D}{\lambda}\varphi\right)^2 \quad \text{for} \quad 0 < \varphi<\varphi_m \tag{6-13}$$

$$G(\varphi)=G_1\,G(\varphi)=G_1 \quad \text{for} \quad \varphi_m\le\varphi<100\frac{\lambda}{D} \tag{6-14}$$

$$G(\varphi)=52-10\log\frac{D}{\lambda}-25\log\varphi \quad \text{for} \quad 100\frac{\lambda}{D}\le\varphi<48^\circ \tag{6-15}$$

$$G(\varphi)=10-10\log\frac{D}{\lambda} \quad \text{for} \quad 48^\circ\le\varphi\le180^\circ \tag{6-16}$$

c) In cases where only the maximum antenna gain is known, D/λ can be estimated from the following expression:

$$20\log\frac{D}{\lambda}\approx G_{a\max}-7.7 \tag{6-17}$$

where

G_{amax}: main beam axis antenna gain (dBi).

D: antenna diameter (m)

λ: wavelength (m)

G_1: gain of the first side lobe (dBi)

4 Determination of a supplementary contour using the time-variant gain (TVG) method

The TVG method requires the cumulative distribution of the time-varying horizon antenna gain of an earth station operating with a non-geostationary space station. In comparison to the TIG method, the TVG method usually produces smaller distances, but requires greater effort in determining the cumulative distribution of the horizon gain of the earth station antenna for each azimuth to be considered.

The TVG method closely approximates the convolution of the distribution of the horizon gain of the earth station antenna and the propagation mode (1) path loss. This method may produce slightly smaller distances than those obtained by an ideal convolution. An ideal convolution cannot be implemented due to the limitations of the current model for propagation mode (1). The propagation mode (1) required distance, at the azimuth under consideration, is taken as the largest distance developed from a set of calculations, each of which is based on equation (4) of the main body of this Appendix. For convenience, in these calculations, this equation may be rewritten for the *n*th calculation in the following form:

$$L_b(p_v) - G_e(p_n) = P_t + G_x - P_r(p)\,dB \qquad (6\text{-}18)$$

with the constraint

$$p_v = \begin{cases} 100\ p / p_n & \text{for } p_n \geq 2p \\ 50 & \text{for } p_n < 2p \end{cases} \quad \text{per cent}$$

where:

P_t, $P_r(p)$: as defined in equations in § 1.3 of the main body of this Appendix where p is the percentage of time associated with permissible interference power $P_r(p)$

G_x: maximum antenna gain assumed for the terrestrial station (dBi). Tables 7 and 8 of Annex 7 give values for G_x for the various frequency bands

$G_e(p_n)$: the horizon gain of the coordinating earth station antenna (dBi) that is exceeded for p_n% of the time on the azimuth under consideration

$L_b(p_v)$: the propagation mode (1) minimum required loss (dB) for p_v% of the time; this loss must be exceeded by the propagation mode (1) predicted path loss for all but p_v% of the time.

The values of the percentages of time, p_n , to be used in equation (6-18) are determined in the context of the cumulative distribution of the horizon antenna gain. This distribution needs to be developed for a predetermined set of values of horizon antenna gain spanning the range from the minimum to the maximum values for the azimuth under consideration. The notation $G_e(p_n)$ denotes the value of horizon antenna gain for which the complement of the cumulative distribution of the horizon antenna gain has the value corresponding to the percentage of time p_n. The $p_n$value is the percentage of time that the horizon antenna gain exceeds the *n*th horizon antenna gain value. The procedure in § 4.1 may be used to develop this distribution.

For each value of p_n, the value of horizon antenna gain for this time percentage, $G_e(p_n)$, is used in equation (6-18) to determine a propagation mode (1) minimum required loss. The propagation mode (1) predicted path loss is to exceed this propagation mode (1) required loss for no more than p_v per cent of the time, as specified by the constraint associated with equation (6-18). A series of propagation mode (1) distances are then determined using the procedures described in § 4 of the main body of this Appendix.

The propagation mode (1) required distance is then the maximum distance in the series of propagation mode (1) distances that are obtained for any value of p_n, subject to the constraint associated with equation (6-18). A detailed description of the method for using equation (6-18) to determine the propagation mode (1) required distance is provided in § 4.2.

Further information, including examples, may be found in the latest version of Recommendation ITU-R SM.1448.

4.1 Determination of the horizon antenna gain distribution for the TVG method

The time-variant gain (TVG) method for the determination of an earth station's supplementary contour requires the determination of the horizon antenna gain statistics for all azimuths (in suitable increments, e.g. 5°) around the earth station. In considering the horizon antenna gain of the antenna for either a transmitting or a receiving earth station, only the horizon antenna gain values during the operational time are to be considered. In developing the cumulative distributions of horizon antenna gain, the percentages of time are percentages of operational time. Thus, there may be periods of time for which no horizon antenna gain is specified.

The determination of the horizon antenna gain distribution requires both earth station and orbital information including whether or not station keeping is used to maintain a single orbital path (repeating/non-repeating ground track system). The cumulative distribution of the time-varying horizon gain of a transmitting or a receiving earth station antenna operating with non-geostationary space stations is calculated as follows:

Step 1 Simulate the constellation of non-geostationary space stations over a sufficiently long period, with a time step appropriate for orbit altitude, to obtain a valid representation of the antenna gain variations. For repeating ground track constellations, simulate the orbital path for each satellite visible from the earth station over a period of the ground track. For non-repeating ground track constellations, simulate the orbit of each satellite in the constellation over a period long enough to get a stable representation of the distribution.

Step 2 At each time step, determine the azimuth and elevation angle of each satellite that is both visible at the earth station and above the minimum elevation angle at which the earth station operates. In addition to the minimum elevation angle, other criteria could be used to avoid certain geometric configurations, e.g. geostationary orbit arc avoidance (no transmission between an earth station and a non-geostationary satellite that is within ± X° from the geostationary orbit arc).

Step 3 At each step, and for each satellite in communication with the earth station, use the actual earth station antenna pattern, or a formula giving a good approximation of it, to calculate the gain towards the horizon at each azimuth and elevation angle around the earth station.

Step 4 Choose a gain increment g (dB) and partition the gain range by a number of gain levels between G_{min} and G_{max}, i.e. $G = \{G_{min}, G_{min} + g, G_{min} + 2g, ..., G_{max}\}$.

These gain levels determine a set of gain intervals so that the nth gain interval (n = 1, 2, 3, ...) includes gain values equal to, or greater than, $G_{min} + (n - 2)g$ and less than $G_{min} + (n - 1)g$.

A value of g = 0.1 to 0.5 dB is recommended.

For each azimuth on the horizon around the earth station, accumulate the time that the horizon gain takes a value in each gain interval of width g (dB).

Step 5 The probability density function (pdf) on each azimuth is determined by dividing the time in each gain interval by the total simulation time.

Step 6 Determine the cumulative distribution function (cdf) of horizon antenna gain at each azimuth by accumulating the gain density function at that azimuth. The value of the required cdf at any specific gain value is the percentage of time that the gain is less than, or equal to, that gain value.

4.2 Determination of the supplementary contour distance using the TVG method

This calculation is based on a cumulative distribution of the horizon gain of the earth station antenna for each azimuth to be considered (in suitable angular increments e.g. 5°). Appropriate distributions for this purpose may be developed by the method in § 4.1. The process for calculating the supplementary contour distance for each azimuth is described in the following procedure.

Step 1 From the complementary cumulative distribution of the horizon antenna gain, for the azimuth under consideration, determine the percentage of time p_n that the horizon gain exceeds the level G_{en}, where

$$G_{en} = G_{min} + (n-1)g \quad (n=1,2,3,...) \tag{6-19}$$

with

G_{min}: the minimum value of horizon gain, and

g: is a gain increment

Step 2 For each percentage p_n that is equal to or greater than 2p%, the percentage of time to be used in determining the propagation mode (1) path loss is p_v.

$$p_v = 100\, p / p_n \,\% \text{ for } p_n \geq 2p\,\% \tag{6-20}$$

For each percentage of time, determine the distance, d_n (km), for which the propagation mode (1) predicted path loss is equal to the propagation mode (1) minimum required loss, using the propagation model in accordance with § 4 of the main body of this Appendix and the equation

$$L_{bn}(p_v) = P_t + G_{en} + G_x - P_r(p) \quad dB \tag{6-21}$$

The values of p_v must be within the range of percentage of time of the propagation mode (1) model (see §1.5.1 of the main body of this Appendix).

Step 3 The propagation mode (1) required distance for the azimuth under consideration is the largest of the distances, d_n (km), calculated in Step 2, except when this largest distance is attained for the smallest value of p_n that is equal to or greater than $2p$ in accordance with equation (6-20) in Annex 6. In such cases, the propagation mode (1) required distance for the azimuth under consideration is the distance determined from equation (6-21) in Annex 6 with $G_{en} = G_{max}$ and $p_v = 50\%$ where G_{max} is the maximum value of horizon antenna gain.

Step 4 The propagation mode (1) supplementary contour distance for the azimuth under consideration is the required distance as determined in Step 3, except that the distance must be between the minimum coordination distance (d_{min}) and the maximum coordination distance (d_{max1}). These limits are given in § 4.2 and § 4.3 of the main body of this Appendix, respectively.

ANNEX 7

System parameters and predetermined coordination distances for determination of the coordination area around an earth station

1 Introduction

Tables 7 to 9 contain the system parameter values required by the methods in the main body of this Appendix to determine the coordination area around an earth station when the band is shared with terrestrial radiocommunication services or other earth stations operating in the opposite direction of transmission.

Table 7 is limited to those system parameter values required for the case of a transmitting earth station sharing with terrestrial services; Table 8 is limited to those parameter values required for the case of a receiving earth station sharing with terrestrial services; Table 9 is limited to those parameter values required for the case of a transmitting earth station which is sharing in a bidirectionally allocated band with other earth stations operating in the opposite direction of transmission.

These system parameter tables include primary allocations to the space and terrestrial services in Article S5 in all bands between 100 MHz and 105 GHz. Some of the columns have incomplete information. In some cases, this is because there is no requirement to calculate coordination distances as pre-determined coordination distances apply. In other cases, the service allocations are new and the systems may not be introduced for some years. Hence, the system parameters are the subject of ongoing development within the ITU-R study groups.

Parameters specific to the earth station, for which coordination is being sought, are provided to BR in the format specified in Appendix S4 as part of the notification and coordination procedures.

The row in each table entitled "method to be used" directs the user to the appropriate section of the main body of this Appendix which describes the methods to be followed for the determination of the coordination area.

Note that the earth station for which the coordination area is to be determined is identified by the service designation given in the first row of each table.

When a supplementary contour is to be developed, for example for digital fixed systems, the necessary system parameters may be found in one of the adjacent columns in Tables 7, 8 and 9 in this Annex. If no suitable system parameters are available, then the value of the permissible interference power ($P_r(p)$) may be calculated using equation (7-1) in § 2.

The predetermined coordination distances specified in Table 10 are used for transmitting and receiving earth stations, in cases defined by the corresponding frequency sharing situation.

2 Calculation of the permissible interference power of an interfering emission

Tables 7, 8 and 9 contain values for the parameters which are required for the calculation of the permissible interference power of the interfering emission (dBW), in the reference bandwidth, to be exceeded for no more than p% of the time at the receiving antenna terminal of a station subject to interference, from a single source of interference, using the general formula:

$$P_r(p)=10\log(kT_eB)+N_L+10\log(10^{M_s/10}-1)-W \quad dBW \tag{7-1}$$

where:

k: Boltzmann's constant, 1.38×10^{-23} J/K

T_e: thermal noise temperature of the receiving system (K), at the terminal of the receiving antenna (see § 2.1 of this Annex)

N_L: link noise contribution (see § 2.2 of this Annex)

B: reference bandwidth (Hz), i.e. the bandwidth in the receiving station that is subject to the interference and over which the power of the interfering emission can be averaged

p: percentage of the time during which the interference from one source may exceed the permissible interference power value; since the entries of interference are not likely to occur simultaneously, $p = p_0/n$

p_0: percentage of the time during which the interference from all sources may exceed the threshold value

n: number of equivalent, equal level, equal probability entries of interference, assumed to be uncorrelated for small percentages of the time

M_s: link performance margin (dB) (see § 2.3 of this Annex)

W: a thermal noise equivalence factor (dB) for interfering emissions in the reference bandwidth; it is positive when the interfering emissions would cause more degradation than thermal noise (see § 2.4 of this Annex).

In certain cases, an administration may have reason to believe that, for its receiving earth station, a departure from the values associated with the earth station, as listed in Table 8, may be justified. Attention is drawn to the fact that for specific systems the bandwidths B or, for example in the case of demand assignment systems, the percentages of the time p and p_0 may have to be changed from the values given in Table 8.

2.1 Calculation of the noise temperature of the receiving system

The noise temperature (K) of the receiving system, referred to the output terminals of the receiving antenna, may be determined (unless specifically given in Table 7) from:

$$T_e = T_a + (\ell_{tl} - 1)290 + \ell_{tl} T_r \quad K \tag{7-2}$$

where:

T_a: noise temperature (K) contributed by the receiving antenna

ℓ_{tl}: numerical loss in the transmission line (e.g. a waveguide) between the antenna terminal and the receiver front end

T_r: noise temperature (K) of the receiver front end, including all successive stages at the front end input.

For radio-relay receivers and where the waveguide loss of a receiving earth station is not known, a value of $\ell_{tl} = 1.0$ is used.

In case of determination of the coordination contours between two earth stations operating in the opposite direction of transmission, the following earth station receiving system noise temperatures should be used if the value is not provided in Table 9. This assumption is necessary because the receiving earth station takes the place of a receiving terrestrial station in the calculations.

TABLE 6

Frequency range (GHz)	T_e (K)
$f < 10$	75
$10 < f < 17$	150
$f > 17$	300

2.2 Determination of the factor N_L

The factor N_L is the noise contribution to the link. In the case of a satellite transponder, it includes the uplink noise, intermodulation, etc. In the absence of table entries, it is assumed:

N_L = 1 dB for fixed-satellite links

= 0 dB for terrestrial links.

2.3 Determination of the factor M_s

The factor M_s is the factor by which the link noise under clear-sky conditions would have to be raised in order to equal the permissible interference power.

2.4 Determination of the factor *W*

The factor *W* (dB) is the level of the radio-frequency thermal noise power relative to the received power of an interfering emission which, in the place of the former and contained in the same (reference) bandwidth, would produce the same interference (e.g. an increase in the voice or video channel noise power, or in the bit error ratio). The factor *W* generally depends on the characteristics of both the wanted and the interfering signals.

When the wanted signal is digital, *W* is usually equal to or less than 0 dB, regardless of the characteristics of the interfering signal.

3 Horizon antenna gain for a receiving earth station with respect to a transmitting earth station

For the determination of the coordination area of a transmitting earth station with respect to a receiving earth station in a bidirectionally allocated band, it is necessary to calculate the horizon antenna gain of the unknown earth station. In cases where the unknown receiving earth stations operate with geostationary satellites, Table 9 provides the necessary receiving earth station parameters for the calculation procedure, which is described in § 2.1 of Annex 5.

In the case where the unknown receiving earth station operates with non-geostationary satellites, the horizon antenna gain to be used for all azimuths is provided in Table 9. The tabulated values were determined by using the method described in § 2.2 of the main body of this Appendix, which uses the maximum and minimum values of horizon antenna gain. For this purpose the maximum horizon antenna gain is the gain of the antenna for an off-axis angle equal to the minimum operating elevation angle. The minimum horizon antenna gain is the gain at large off-axis angles, usually more than 36° or 48°.

In determining the TIG horizon antenna gain entries in Table 9, the difference between the maximum and minimum horizon antenna gain did not exceed 30 dB. Consequently, the TIG horizon antenna gain was taken as the lesser of the maximum horizon antenna gain or 20 dB more than the minimum horizon antenna gain. For the purpose of determining the TIG horizon antenna gain, the reference antenna pattern of § 3 of Annex 3 was used, except in cases noted in the tables where a different pattern was deemed to be more appropriate.

TABLE 7a

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		**Mobile-satellite**		**Mobile-satellite, space operation**	**Earth exploration-satellite, meteorological satellite**		**Space operation**	**Space research, Space operation**	**Mobile-satellite**	**Space operation**		**Mobile-satellite, radio-determination satellite**	**Mobile-satellite**		**Mobile-satellite**		**Space operation, Space research**		**Mobile-satellite**		**Space research, Space operation, Earth exploration-satellite**
Frequency bands (MHz)		121.45-121.55		148.0-149.9	401-403		433.75-434.25	449.75-450.25	806-840	1 427-1 429		1 610-1 626.5	1 675-1 700		1 675-1 710		1 750-1 850		1 980-2 025		2 025-2 110 2 110-2 120 (Deep space)
Receiving terrestrial service designations		Aeronautical mobile		Fixed, mobile	Fixed, mobile, meteorological aids		Amateur, radio-location fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile broadcasting, aeronautical radionavigation	Fixed, mobile		Aeronautical, radionavigation	Meteoro-logical aids		Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile
Method to be used		§ 1.4.7		§ 2.1, § 2.2	§ 2.1, § 2.2		§ 2.1, § 2.2	§ 2.1, § 2.2	§ 1.4.6	§ 2.1, § 2.2		§ 1.4.6	§ 1.4.6		§ 1.4.6		§ 2.1, § 2.2		§ 1.4.6		§ 2.1, § 2.2
Modulation at terrestrial station (1)		A	N	A	A	N		A&N	A&N	A	N		A	N	A	N	A	N	A	N	A
Terrestrial Station Interference Parameters And Criteria	$p0$(%)			1.0				0.01	0.01	0.01	0.01				0.01	0.01	0.01	0.01	0.01		0.01
	n			1				2	2	2	2				2	2	2	2	2		2
	p(%)			1.0				0.005	0.005	0.005	0.005				0.005	0.005	0.005	0.005	0.005		0.005
	N_L (dB)			-				0	0	0	0				0	0	0	0	0		0
	M_s (dB)			-				20	20	33	33				33	33	33	33	26(2)		26(2)
	W (dB)			-				0	0	0	0				0	0	0	0	0		0
Terrestrial station parameters	G_x (dBi) (3)			8				16	16	33	33				35	35	35	35	49(2)		49(2)
	T_e (K)			-				750	750	750	750				750	750	750	750	500(2)		500(2)
Reference bandwidth	B (Hz)			14×10^3				12.5×10^3	12.5×10^3	4×10^3	10^6				4×10^3	10^6	4×10^3	10^6	4×10^3		4×10^3
Permissible interference power	$P_r(p)$ (dBW) in B			−153				−139	−139	−131	−107				−131	−107	−131	−107	−140		−140

(1) A: analogue modulation; N: digital modulation.

(2) The parameters for the terrestrial station associated with transhorizon systems have been used. Line-of-sight radio-relay parameters associated with the frequency band 1 675-1 710 MHz may also be used to determine a supplementary contour.

(3) Feeder losses are not included.

TABLE 7b

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		**Fixed-satellite, mobile-satellite**	**Fixed-satellite**	**Fixed-satellite**	**Fixed-satellite**		**Space operation, space research**		**Fixed-satellite, mobile-satellite, meteorological-satellite**		**Fixed-satellite**		**Fixed-satellite**		**Fixed-satellite**	**Fixed-satellite (3)**	**Fixed-satellite**	**Fixed-satellite (3)**
Frequency bands (GHz)		2.655-2.690	5.091-5.150	5.725-5.850	5.725-7.075		7.100-7.235 (5)		7.900-8.400		10.7-11.7		12.5-14.8		13.75-14.3	15.43-15.65	17.7-18.4	19.3-19.7
Receiving terrestrial service designations		Fixed, mobile	Aeronautical radio-navigation	Radio-location	Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile		Radiolocation radio-navigation	Aeronautical radionavigation	Fixed, mobile	Fixed, mobile
Method to be used		§ 2.1		§ 2.1	§ 2.1		§ 2.1, § 2.2		§ 2.1		§ 2.1		§ 2.1, § 2.2				§ 2.1, § 2.2	§ 2.2
Modulation at terrestrial station (1)		A			A	N	A	N	A	N	A	N	A	N			N	N
Terrestrial Station interference	p_0(%)	0.01			0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005			0.005	0.005
	n	2			2	2	2	2	2	2	2	2	2	2			2	2
	p(%)	0.005			0.005	0.0025	0.005	0.0025	0.005	0.0025	0.005	0.0025	0.005	0.0025			0.0025	0.0025
Parameters And Criteria	N_L (dB)	0			0	0	0	0	0	0	0	0	0	0			0	0
	M_s (dB)	26 (2)			33	37	33	37	33	37	33	40	33	40			25	25
	W (dB)	0			0	0	0	0	0	0	0	0	0	0			0	0
Terrestrial station	G_X (dBi) (4)	49 (2)	6		46	46	46	46	46	46	50	50	52	52			48	48
Parameters	T_e (K)	500 (2)			750	750	750	750	750	750	1 500	1 100	1 500	1 100			1 100	1 100
Reference bandwidth	B (Hz)	4×10^3	150×10^3		4×10^3	10^6	4×10^3	10^6	4×10^3	10^6	4×10^3	10^6	4×10^3	10^6			10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B	−140	−160		−131	−103	−131	−103	−131	−103	−128	−98	−128	−98			−113	−113

(1) A: analogue modulation; N: digital modulation.

(2) The parameters for the terrestrial station associated with transhorizon systems have been used. Line-of-sight radio-relay parameters associated with the frequency band 5 725-7 075 MHz may also be used to determine a supplementary contour with the exception that G_X = 37 dBi.

(3) Feeder links of non-geostationary satellite systems in the mobile-satellite service.

(4) Feeder losses are not included.

(5) Actual frequency bands are 7 100-7 155 MHz and 7 190-7 235 MHz for space operation service and 7 145-7 235 MHz for the space research service.

TABLE 7c

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		**Fixed-satellite**	**Fixed-satellite (2)**	**Fixed-satellite (3)**	**Space research**	**Earth exploration-satellite, space research**	**Fixed-satellite, mobile-satellite, radionavigation satellite**	**Fixed-satellite (2)**	**Fixed-satellite, mobile-satellite**	**Fixed-satellite**	**Fixed-satellite**
Frequency bands (GHz)		24.75-25.25 27.0-29.5	28.6-29.1	29.1-29.5	34.2-34.7	40.0-40.5	42.5-51.4	47.2-50.2	71.0-75.5	92.0-94.0	94.1-95.0
Receiving terrestrial service designations		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile	Fixed, mobile, radionavigation	Fixed, mobile	Fixed, mobile	Fixed, mobile, radiolocation	Fixed, mobile, radiolocation
Method to be used		§ 2.1	§ 2.2	§ 2.2		§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.2	§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.1, § 2.2
Modulation at terrestrial station (1)		N	N	N		N	N	N	N	N	N
Terrestrial station interference parameters and criteria	p_0(%)	0.005	0.005	0.005		0.005	0.005	0.001	0.002	0.002	0.002
	n	1	2	1		1	1	1	2	2	2
	p(%)	0.005	0.0025	0.005		0.005	0.005	0.001	0.001	0.001	0.001
	N_L (dB)	0	0	0		0	0	0	0	0	0
	M_s (dB)	25	25	25		25	25	25	25	25	25
	W (dB)	0	0	0		0	0	0	0	0	0
Terrestrial station parameters	G_x (dBi) (4)	50	50	50		42	42	46	45	45	45
	T_e (K)	2 000	2 000	2 000		2 600	2 600	2 000	2 000	2 000	2 000
Reference bandwidth	B (Hz)	10^6	10^6	10^6		10^6	10^6	10^6	10^6	10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B	−111	−111	−111		−110	−110	−111	−111	−111	−111

(1) A: analogue modulation; N: digital modulation.

(2) Non-geostationary satellites in the fixed-satellite service.

(3) Feeder links to non-geostationary-satellite systems in the mobile-satellite service.

(4) Feeder losses are not included.

TABLE 8a

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Space operation, space research	Meteoro-logical satellite, mobile satellite	Space research	Space research, space operation	Space operation	Mobile satellite	Meteoro-logical satellite	Mobile-satellite	Space research space operation	Space operation	Meteoro-logical satellite Earth exploration-satellite	Space operation	Broad-casting satellite	Mobile satellite	Broadcasting satellite (DAB)	Mobile satellite, land-mobile satellite, maritime mobile satellite
Frequency band (MHz)			137-138	137-138	143.6-143.65	174-184	163-167 272-273(5)	335.4-399.9	400.15-401	400.15-401	400.15-401	401-402	460-470	549.75-550.25	620-790	856-890	1 452-1 492	1 492-1 530 1 555-1 559 2 160-2 200 (1)
Transmitting terrestrial service designations			Fixed, mobile	Fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile, broad-casting	Fixed, mobile	Fixed, mobile	Meteoro-logical aids	Meteoro-logical aids	Meteoro-logical aids	Meteoro-logical aids, fixed, mobile	Fixed, mobile	Fixed, mobile, broad-casting	Fixed, mobile, broad-casting	Fixed, mobile, broad-casting	Fixed, mobile, broadcasting	Fixed, mobile
Method to be used			§ 2.1	§ 2.1	§ 2.1	§ 2.1	§ 2.1	§ 1.4.6	§ 1.4.6	§ 1.4.6	-	§ 2.1	§ 2.1	§ 2.1	§ 1.4.5	§ 1.4.6	§ 1.4.5	§ 1.4.6
Modulation at earth station (2)			N		N		N				N	N					N	N
Earth station Interference Parameters and criteria	p_0 (%)		0.1		0.1		1.0		0.012		0.1	0.1	0.012					10
	n		2		2		1		1		2	2	1					1
	p (%)		0.05		0.05		1.0		0.012		0.05	0.05	0.012					10
	N_L (dB)		0		0		0		0		0	0						0
	M_s (dB)		1		1		1		4.3		1	1						1
	W (dB)		0		0		0		0		0	0						0
Terrestrial Station Parameters	E (dBW) in B (3)	A	-		-		15				-	-	5				38	37(4)
		N	-		-		15				-	-	5				38	37
	P_t (dBW) in B	A	-		-		−1				-	-	−11				3	0
		N	-		-		−1				-	-	−11				3	0
	G_x (dBi)		-		-		16				-	-	16				35	37
Reference bandwidth	B (Hz)		1		1		10^3		177.5×10^3		1	1	85				25×10^3	4×10^3
Permissible interference power	$P_r(p)$ (dBW) in B		−199		−199		−173		−148		−208	−208	−178					−176

(1) In the band 2 160-2 200 MHz, the terrestrial station parameters of line-of-sight radio-relay systems have been used. If an administration believes that, in this band transhorizon systems need to be considered, the parameters associated with the frequency band 2 500-2 690 MHz may be used to determine the coordination area.

(2) A: analogue modulation; N: digital modulation.

(3) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(4) This value is reduced from the nominal value of 50 dBW for the purposes of determination of coordination area, recognizing the low probability of high power emissions falling fully within the relatively narrow bandwidth of the earth station.

(5) The fixed-service parameters provided in the column for 163-167 MHz and 272-273 MHz are only applicable to the band 163-167 MHz.

TABLE 8b

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Space operation (GSO and non-GSO)	Radio-navigation satellite	Meteoro-logical satellite (non-GSO)	Meteoro-logical satellite (GSO)	Space research near Earth (non-GSO & GSO)		Space research deep space (non-GSO)	Space operation (non-GSO and GSO)	Earth exploration-satellite (GSO)	Broadcasting satellite	Mobile satellite, radio-determination satellite	Fixed satellite, broadcasting satellite		Fixed satellite	
							Unmanned	Manned									
Frequency band (GHz)			1.525-1.535	1.559-1.610	1.670-1.710	1.670-1.710	1.700-1.710 2.200-2.290		2.290-2.300	2.200-2.290	2.200-2.290	2.310-2.360	2.4835-2.500 (6)	2.500-2.690		3.400-4.200	
Transmitting terrestrial service designations			Fixed	Fixed	Fixed, mobile, meteoro-logical aids	Fixed, mobile, meteoro-logical aids	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile, radiolocation	Fixed, mobile, radiolocation	Fixed, mobile radiolocation		Fixed, mobile	
Method to be used			§ 2.1, § 2.2	§ 2.1	§ 2.2 and (1)	§ 2.1 and (1)	§ 2.1, § 2.2		§ 2.2	§ 2.1, § 2.2	§ 2.1	§ 1.4.5	§ 1.4.6	§ 1.4.5 and § 2.1		§ 2.1	
Modulation at earth station (2)			N		N	N	N		N	N	N		N	A	N	A	N
Earth station Interference Parameters and criteria	p_0 (%)		1.0		0.006	0.011	0.1	0.001	0.001	1.0	1.0		10	0.03	0.003	0.03	0.005
	n		1		3	2	2	1	1	2	2		1	3	3	3	3
	p (%)		1.0		0.002	0.0055	0.05	0.001	0.001	0.5	0.5		10	0.01	0.001	0.01	0.0017
	N_L (dB)		0		0	0	0		0	0			0	1	1	1	1
	M_s (dB)		1		2.8	0.9	1		0.5	1			1	7	2	7	2
	W (dB)		0		0	0	0		0	0			0	4	0	4	0
Terrestrial Station Parameters	E (dBW) in B (3)	A	50		92(4)	92(4)	−27(4,5)		−27(5)	72(4)	72(4)		37	72(4)	72(4)	55	55
		N	37		-	-	−27		−27	76	76		37	76	76	42	42
	P_t (dBW) in B	A	13		40(4)	40(4)	−71(4,5)		−71(5)	28(4)	28(4)		0	28(4)	28(4)	13	13
		N	0		-	-	−71		−71	32	32		0	32	32	0	0
	G_x (dBi)		37		52	52	44		44	44	44		37	44	44	42	42
Reference bandwidth	B (Hz)		10^3		10^6	4×10^3	1		1	10^6	10^6		4×10^3	10^6	10^6	10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B		−184		−142	−177	−216		−222	−154	−154		−176				

(1) See Table 10 of this Annex.

(2) A: analogue modulation; N: digital modulation.

(3) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(4) In this band, the parameters for the terrestrial stations associated with transhorizon systems have been used. If an administration believes that transhorizon systems do not need to be considered, the line-of-sight radio-relay parameters associated with the frequency band 3.4-4.2 GHz may be used to determine the coordination area, with the exception that E = 50 dBW for analogue terrestrial stations; and Gx = 37 dBi. However, for the space research service only, noting footnote[5] when transhorizon systems are not considered, E = 20 dBW and Pt = –17 dBW for analogue terrestrial stations, E = –23 dBW and Pt = –60 dBW for digital terrestrial stations; and
Gx = 37 dBi.

(5) These values are estimated for 1 Hz bandwidth and are 30 dB below the total power assumed for emission.

(6) In the band 2.4835-2.5 GHz the terrestrial station parameters of line-of-sight radio-relay systems have been used. If an administration believes that, in this band, transhorizon systems need to be considered, the parameters associated with the frequency band 2 500-2 690 MHz may be used to determine the coordination area.

TABLE 8c

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Fixed satellite		Fixed satellite radio-determination satellite	Fixed satellite	Fixed satellite		Meteoro-logical satellite (7,8)	Meteoro-logical satellite (9)	Earth exploration-satellite (7)	Earth exploration-satellite (9)	Space research (10)		Fixed satellite		Broadcasting-satellite		Fixed satellite (9)	Broad-casting satellite	Fixed satellite (7)
													Deep space								
Frequency band (GHz)			4.500-4.800		5.150-5.216	6.700-7.075	7.250-7.750		7.450-7.550	7.750-7.850	8.025-8.400	8.025-8.400	8.400-8.450	8.450-8.500	10.7-12.75		12.5-12.75 (12)		15.4-15.7	17.7-17.8	17.7-18.8 19.3-19.7
Transmitting terrestrial service designations			Fixed, mobile		Aeronautical radio-navigation	Fixed, mobile	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile		Fixed, mobile		Fixed, mobile		Aeronautical radio-navigation	Fixed	Fixed, mobile
Method to be used			§ 2.1		§ 2.1	§ 2.2	§ 2.1		§ 2.1, § 2.2	§ 2.2	§ 2.1	§ 2.2	§ 2.2		§ 2.1, § 2.2		§ 1.4.5			§ 1.4.5	§ 2.1
Modulation at earth station (1)			A	N		N	A	N	N	N	N	N	N	N	A	N	A	N	-		N
Earth station Interference Parameters and criteria	p_0 (%)		0.03	0.005		0.005	0.03	0.005	0.002	0.001	0.083	0.011	0.001	0.1	0.03	0.003	0.03	0.003	0.003		0.003
	n		3	3		3	3	3	2	2	2	2	1	2	2	2	1	1	2		2
	p (%)		0.01	0.0017		0.0017	0.01	0.0017	0.001	0.0005	0.0415	0.0055	0.001	0.05	0.015	0.0015	0.03	0.003	0.0015		0.0015
	N_L (dB)		1	1		1	1	1	-	-	1	0	0	0	1	1	1	1	1		1
	M_s (dB)		7	2		2	7	2	-	-	2	4.7	0.5	1	7	4	7	4	4		6
	W (dB)		4	0		0	4	0	-	-	0	0	0	0	4	0	4	0	0		0
Terrestrial Station Parameters	E (dBW) in B (2)	A	92(3)	92(3)		55	55	55	55	55	55	55	25(5)	25(5)	40	40	55	55			35
		N	42(4)	42(4)		42	42	42	42	42	42	42	−18	−18	43	43	42	42		40	40
	P_t (dBW) in B	A	40(3)	40(3)		13	13	13	13	13	13	13	−17(5)	−17(5)	−5	−5	10	10			−10
		N	0	0		0	0	0	0	0	0	0	−60	−60	−2	−2	−3	−3		−7	−5
	G_x (dBi)		52(3,4)	52(3,4)		42	42	42	42	42	42	42	42	42	45	45	45	45		47	45
Reference band-width(6)	B (Hz)		10^6	10^6		10^6	10^6	10^6	10^7	10^7	10^6	10^6	1	1	10^6	10^6	27 10^6	27 10^6			10^6
Permissible interference power	$P_r(p)$ (dBW) in B					−151.2			−125	−125	−154 (11)	−142	−220	−216			−131	−131			

(1) A: analogue modulation; N: digital modulation.

(2) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(3) In this band, the parameters for the terrestrial stations associated with transhorizon systems have been used. If an administration believes that transhorizon systems do not need to be considered, the line-of-sight radio-relay parameters associated with the frequency band 3.4-4.2 GHz may be used to determine the coordination area.

(4) Digital systems assumed to be non-transhorizon. Therefore Gx = 42.0 dBi. For digital transhorizon systems, parameters for analogue transhorizon systems above have been used.

(5) These values are estimated for 1 Hz bandwidth and are 30 dB below the total power assumed for emission.

(6) In certain systems in the fixed-satellite service it may be desirable to choose a greater reference bandwidth B. However, a greater bandwidth will result in smaller coordination distances and a later decision to reduce the reference bandwidth may require recoordination of the earth station.

(7) Geostationary-satellite systems.

(8) Non-geostationary-satellites in the meteorological-satellite service notified in accordance with No. **S5.461A** may use the same coordination parameters.

(9) Non-geostationary-satellite systems.

(10) Space research earth stations in the band 8.4-8.5 GHz operate with non-geostationary satellites.

(11) For large earth stations: $P_r(p) = (G \quad 180)$ dBW

For small earth stations: $P_r(20\%) = 2\ (G - 26) - 140$ dBW for $26 < G \leq 29$ dBi

$P_r(20\%) = G - 163$ dBW for $G > 29$ dBi

$P_r(p)\% = G - 163$ dBW for $G \leq 26$ dBi

(12) Applies to the broadcasting-satellite service in unplanned bands in Region 3.

TABLE 8d

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Meteoro-logical satellite	Fixed satellite	Fixed satellite (3)	Broad-casting satellite	Earth exploration-satellite (4)	Earth exploration-satellite (5)	Space research (Deep Space)	Space research		Fixed satellite (6)	Fixed satellite (5)	Mobile satellite	Broadcasting satellite, Fixed satellite	Mobile satellite	Radio-navigation	Broadcasting satellite
										Un-manned	Manned							
Frequency band (GHz)			18.1-18.3	18.8-19.3	19.3-19.7	21.4-22.0	25.5-27.0	25.5-27.0	31.8-32.3	37.0-38.0		37.5-40.5	37.5-40.5	39.5-40.5	40.5-42.5	43.5-47.0	43.5-47.0	84-86
Transmitting terrestrial service designations			Fixed, mobile	Fixed, Mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, radio-navigation	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Broadcasting, fixed	Mobile	Mobile	Fixed, mobile, broadcasting
Method to be used			§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.2	§ 1.4.5	§ 2.2	§ 2.1	§ 2.1, § 2.2	§ 2.1, § 2.2		§ 2.2	§ 2.1	§ 1.4.6	§ 1.4.5, § 2.1	§ 1.4.6	-	§ 1.4.5
Modulation at earth station (1)			N	N	N		N	N	N	N		N	N	N	-	N		
Earth station interference parameters and criteria	p_0 (%)			0.003	0.01		0.25	0.25	0.001	0.1	0.001	0.02	0.003					
	n			2	1		2	2	1	1	1		2					
	p (%)			0.0015	0.01		0.125	0.125	0.001	0.1	0.001		0.0015					
	N_L (dB)			0	0		0	0	0	0		1	1					
	M_s (dB)			5	5		11.4	14	1	1		6.8	6					
	W (dB)			0	0		0	0	0	0		0	0					
Terrestrial station parameters	E (dBW) in B (2)	A		-	-		-	-	-	-		-	-	-	-			
		N	40	40	40	40	42	42	-28	-28		35	35	35	44	40	40	
	P_t (dBW) in B	A		-	-		-	-	-	-		-	-	-	-			
		N	-7	-7	-7	-7	-3	-3	-81	-73		-10	-10	-10	-1	-7	-7	
	G_x (dBi)		47	47	47	47	45	45	53	45		45	45	45	45	47	47	
Reference bandwidth	B (Hz)			10^6	10^6		10^7	10^7	1	1		10^6	10^6	10^6	10^6			
Permissible interference power	$P_r(p)$ (dBW) in B			-140	-137		-120	-116	-216	-217		-140						

(1) A: analogue modulation; N: digital modulation.

(2) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(3) Non-geostationary mobile-satellite service feeder links.

(4) Non-geostationary-satellite systems.

(5) Geostationary-satellite systems.

(6) Non-geostationary fixed-satellite systems.

TABLE 9A

Parameters required for the determination of coordination distance for a transmitting earth station in bands shared bidirectionally with receiving earth stations

Space service designation in which the transmitting earth station operates		**Land mobile-satellite**	**Mobile-satellite**	**Land mobile-satellite**	**Earth exploration-satellite, meteoro-logical satellite**	**Mobile-satellite**		**Mobile-satellite**		**Fixed satellite, mobile satellite**	**Fixed satellite (3)**		**Fixed satellite**	**Fixed satellite, meteorological satellite**	**Fixed satellite**
Frequency bands (GHz)		0.1499-0.15005	0.272-0.273	0.3999-0.40005	0.401-0.402	1.675-1.710		1.700-1.710		2.655-2.690	5.150-5.216		6.700-7.075	8.025-8.400	8.025-8.400
Space service designation in which the *receiving* earth station operates		Radio-navigationsatellite	Space operation	Radio-navigation satellite	Space operation	Meteorological satellite		Space research near Earth		Fixed satellite, broadcasting satellite	Fixed satellite	Radio-determination satellite	Fixed satellite	Earth exploration-satellite	Earth exploration-satellite
								Un-Manned (10)	Manned						
Orbit(6)			Non-GSO		Non-GSO	Non-GSO	GSO	Non-GSO			Non-GSO		Non-GSO	Non-GSO	GSO
Modulation at receiving earth station (1)			N		N	N	N	N	N				N	N	N
Receiving earth station interference parameters and criteria	*po*(%)		1.0		0.1	0.006	0.011	0.1	0.001				0.005	0.011	0.083
	n		1		2	3	2	2	1				3	2	2
	p(%)		1.0		0.05	0.002	0.0055	0.05	0.001				0.0017	0.0055	0.0415
	N_L (dB)	0	0	0	0	0	0	0	0				1	0	1
	M_s (dB)	2	1	2	1	2.8	0.9	1	1	2	2	2	2	4.7	2
	W (dB)	0	0	0	0	0	0	0	0				0	0	0
Receiving earth station parameters	G_m(dBi) (2)	0	20	0	20	30	45				48.5		50.7		
	G_r (dBi) (4)	0	19	0	19	19(9)	(8)	10	10		10		10	10	(8)
	ε_{min} (5)	3 °	10°	3 °	10°	5°	3°	5°	5°	3°	3°	3°	3°	5°	3°
	T_e (K) (7)	200	500	200	500	370	118			75	75	75	75		
Reference bandwidth	B (Hz)	4×10^3	10^3	4×10^3	1	10^6	$4x10^3$	1	1				10^6	10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B	−172	−177	−172	−208	−145	−178	−216	−216				−151	−142	−154

(1) A: analogue modulation; N: digital modulation.

(2) On-axis gain of the receive earth station antenna.

(3) Feeder links of non-geostationary-satellite systems in the mobile-satellite service.

(4) Horizon antenna gain for the receive earth station (refer to § 3 of the main body of this Appendix).

(5) Minimum elevation angle of operation in degrees (non-geostationary or geostationary).

(6) Orbit of the space service in which the receiving earth station operates (non-geostationary or geostationary).

(7) The thermal noise temperature of the receiving system at the terminal of the receiving antenna (under clear-sky conditions). Refer to § 2.1 of this Annex for missing values.

(8) Horizon antenna gain is calculated using the procedure of Annex 5. Where no value of G_m is specified, a value of 42 dBi is to be used.

(9) Non-geostationary horizon antenna gain, $G_e = G_{min} + 20$ dB (see § 2.2), with $G_{min} = 10 - 10 \log(D/\lambda)$, $D/\lambda = 13$ (refer to Annex 3 for definition of symbols)

(10) Unmanned space research is not a separate radiocommunication service and the system parameters are only to be used for the generation of supplementary contours.

TABLE 9b

Parameters required for the determination of coordination distance for a transmitting earth station in bands shared bidirectionally with receiving earth stations

Space service designation in which the transmitting earth station operates		**Fixed satellite**			**Fixed satellite**			**Fixed satellite (3)**	**Fixed satellite**	**Fixed satellite**	**Fixed satellite (3)**	**Fixed satellite (3)**	**Earth exploration-satellite, space research**			
Frequency bands (GHz)		10.7-11.7			12.5-12.75			15.43-15.65	17.3-17.8	17.7-18.4	19.3-19.6	19.3-19.6	40.0-40.5			
Space service designation in which the *receiving* earth station operates		Fixed satellite			Fixed satellite			Fixed satellite (3)	Broad-casting satellite	Fixed satellite, meteoro-logical satellite	Fixed satellite (3)	Fixed satellite (4)	Fixed satellite, mobile satellite			
Orbit(7)		GSO		Non-GSO	GSO		Non-GSO	Non-GSO		GSO	Non-GSO	GSO	GSO	Non-GSO		
Modulation at receiving earth station (1)		A	N	N	A	N				N	N					
Receiving earth station Interference Parameters and criteria	p_0(%)	0.03	0.003		0.03	0.003		0.003		0.003	0.01	0.003	0.003			
	n	2	2		2	2		2		2	1	2	2			
	p(%)	0.015	0.0015		0.015	0.0015		0.0015		0.0015	0.01	0.0015	0.0015			
	N_L (dB)	1	1		1	1		1		1	0	1	1			
	M_s (dB)	7	4		7	4		4		6	5	6	6			
	W (dB)	4	0		4	0		0		0	0	0	0			
Receiving earth station parameters	G_m (dBi) (2)			51.9			31.2	48.4		58.6	55.2	49.5	50.8	54.4		
	G_r (5)	(9)	(9)	10	(9)	(9)	11(11)	10		(9)	10	(10)	(9)	7(12)		
	ε_{min} (6)	5°	5°	6°	5°	5°	10°	5°		5°	5°	10°	10°	10°		
	T_e (K) (8)	150	150		150	150		150		300	300	300	300			
Reference bandwidth	B (Hz)	10^6	10^6		10^6	10^6		2×10^6		10^6	10^6					
Permissible interference power	$P_r(p)$ (dBW) in B	−144	−144	−144	−144	−144	−144	−141		−138	−141					

(1) A: analogue modulation; N: digital modulation.

(2) On-axis gain of the receive earth station antenna.

(3) Feeder links of non-geostationary satellite systems in the mobile-satellite service.

(4) Geostationary-satellite systems.

(5) Horizon antenna gain for the receive earth station (refer to § 3 of the main body of the Appendix).

(6) Minimum elevation angle of operation in degrees (non-GSO or GSO).

(7) Orbit of the space service in which the receiving earth station operates (GSO or non-GSO).

(8) The thermal noise temperature of the receiving system at the terminal of the receiving antenna (under clear-sky conditions). Refer to § 2.1 of this Annex for missing values.

(9) Horizon antenna gain is calculated using the procedure of Annex 5. Where no value of G_m is specified, a value of 42 dBi is to be used.

(10) Horizon antenna gain is calculated using the procedure of Annex 5, except that the following antenna pattern may be used in place of that given in § 3 of Annex 3: $G = 32 - 25 \log \phi$ for $1 \leq \phi < 48$; and $G = -10$ for $48 \leq \phi < 180$ (refer to Annex 3 for definition of symbols).

(11) Non-geostationary horizon antenna gain, $G_e = G_{max}$ (see § 2.2 of the main body of this Appendix) for $G = 36 - 25 \log (\phi) > -6$ (refer to Annex 3 for definition of symbols).

(12) Non-geostationary horizon antenna gain, $G_e = G_{max}$ (see § 2.2 of the main body of this Appendix) for $G = 32 - 25 \log (\phi) > -10$ (refer to Annex 3 for definition of symbols).

TABLE 10

Predetermined coordination distances

Frequency sharing situation		**Coordination distance(in sharing situations involving services allocated with equal rights) (km)**
Type of earth station	**Type of terrestrial station**	
Ground-based in the bands below 1 GHz to which No. **S9.11A** applies. Ground-based mobile in the bands within the range 1-3 GHz to which No. **S9.11A** applies	Mobile (aircraft)	500
Aircraft (mobile) (all bands)	Ground-based	500
Aircraft (mobile) (all bands)	Mobile (aircraft)	1 000
Ground-based in the bands: 400.15-401 MHz 1 675-1 700 MHz	Station in the meteorological aids service (radiosonde)	580
Aircraft (mobile) in the bands: 400.15-401 MHz 1 675-1 700 MHz	Station in the meteorological aids service (radiosonde)	1 080
Ground-based in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	100
Airborne earth station in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	400

TABLE 10 *(end)*

Frequency sharing situation		Coordination distance(in sharing situations involving services allocated with equal rights) (km)
Type of earth station	**Type of terrestrial station**	
Receiving earth stations in the meteorological-satellite service	Station in the meteorological aids service	The coordination distance is considered to be the visibility distance as a function of the earth station horizon elevation angle for a radiosonde at an altitude of 20 km above mean sea level, assuming 4/3 Earth radius (see Note 1)
Non-GSO MSS feeder-link earth stations (all bands)	Mobile (aircraft)	500

NOTE 1 - The coordination distance, d (km), for fixed earth stations in the meteorological-satellite service vis-à-vis stations in the meteorological aids service assumes a radiosonde altitude of 20 km and is determined as a function of the physical horizon elevation angle ε_h (degrees) for each azimuth, as follows:

$d = 100$ for $\varepsilon_h \geq 11$

$d = 582\left(\sqrt{1+(0.254\varepsilon_h)^2} - 0.254\varepsilon_h\right)$ for $0 < \varepsilon_h < 11$,

$d = 582$ for $\varepsilon_h \leq 0$

The minimum and maximum coordination distances are 100 km and 582 km, and correspond to physical horizon angles greater than 11° and less than 0°.

APPENDIX S13*

Distress and safety communications (non-GMDSS)

(see Article S30)

Part A1 – General provisions

MOD

§ 2 The procedure specified in this Appendix is obligatory in the maritime mobile-satellite service and for communications between stations on board aircraft and stations of the maritime mobile-satellite service, where this service or stations of this service are specifically mentioned. Paragraphs 1, 3 3), 6 of Part A3, and paragraphs 3 1), 3 4) and 14 1) of Part A4 are also applicable.

Part A6 – Special services relating to safety

Section IV – Narrow-band direct-printing telegraphy system for transmission of navigational and meteorological warnings and urgent information to ships (NAVTEX)

MOD

§ 11 In addition to existing methods, navigational and meteorological warnings and urgent information shall be transmitted by means of narrow-band direct-printing telegraphy, with forward error correction, by selected coast stations.

APPENDIX S17

Frequencies and channelling arrangements in the high-frequency bands for the maritime mobile service

PART B – Channelling arrangements

Section I – Radiotelephony

MOD

5 The following frequencies in Sub-Section A are allocated for calling purposes:

– Channel No. 421 in the 4 MHz band;

– Channel No. 606 in the 6 MHz band;

– Channel No. 821 in the 8 MHz band;

– Channel No. 1221 in the 12 MHz band;

– Channel No. 1621 in the 16 MHz band;

– Channel No. 1806 in the 18 MHz band;

– Channel No. 2221 in the 22 MHz band;

– Channel No. 2510 in the 25 MHz band.

The use of channels 1221 and 1621 for calling purposes shall cease as soon as possible and no later than 31 December 2003 (see Nos. **S52.221A** and **S52.222A**).

The remaining frequencies in Sub-Sections A, B, C-1 and C-2 are working frequencies.

Sub-Section A

Table of single-sideband transmitting frequencies (kHz) for duplex (two-frequency) operation

MOD

2 (Not used)

8 For the conditions of use of the carrier frequency 12 290 kHz, see Nos. **S52.221A** and **S52.222A** and Appendix **S15**.

9 For the conditions of use of the carrier frequency 16 420 kHz, see Nos. **S52.221A** and **S52.222A** and Appendix **S15**.

Sub-Section B

Table of single-sideband transmitting frequencies (kHz) for simplex (single-frequency) operation and for intership cross-band (two-frequency) operation

(See § 4 of Section I of this Appendix)

MOD

4 MHz band[1]		6 MHz band		8 MHz band[2]		12 MHz band	
Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency
4 146	4 147.4	6 224	6 225.4	8 294	8 295.4	12 353	12 354.4
4 149	4 150.4	6 227	6 228.4	8 297	8 298.4	12 356	12 357.4
		6 230	6 231.4			12 362	12 363.4
						12 365	12 366.4

MOD

16 MHz band		18/19 MHz band		22 MHz band		25/26 MHz band	
Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency
16 528	16 529.4	18 825	18 826.4	22 159	22 160.4	25 100	25 101.4
16 531	16 532.4	18 828	18 829.4	22 162	22 163.4	25 103	25 104.4
16 534	16 535.4	18 831	18 832.4	22 165	22 166.4	25 106	25 107.4
		18 834	18 835.4	22 168	22 169.4	25 109	25 110.4
16 540	16 541.4	18 837	18 838.4	22 171	22 172.4	25 112	25 113.4
16 543	16 544.4	18 840	18 841.4	22 174	22 175.4	25 115	25 116.4
16 546	16 547.4	18 843	18 844.4	22 177	22 178.4	25 118	25 119.4

For use of frequencies 12 359 kHz and 16 537 kHz, see Nos. **S52.221A** and **S52.222A**.

APPENDIX S18

Table of transmitting frequencies in the VHF maritime mobile band

(See Article **S52**)

MOD

NOTE – For assistance in understanding the Table, see notes *a)* to *o)* below.

MOD

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		Ship stations	Coast stations		Single frequency	Two frequency	
60		156.025	160.625			x	x
01		156.050	160.650			x	x
61	*m), o)*	156.075	160.675		x	x	x
02	*m), o)*	156.100	160.700		x	x	x
62	*m), o)*	156.125	160.725		x	x	x
03	*m), o)*	156.150	160.750		x	x	x
63	*m), o)*	156.175	160.775		x	x	x
04	*m), o)*	156.200	160.800		x	x	x
64	*m), o)*	156.225	160.825		x	x	x
05	*m), o)*	156.250	160.850		x	x	x
65	*m), o)*	156.275	160.875		x	x	x
06	*f)*	156.300		x			
66		156.325	160.925			x	x
07		156.350	160.950			x	x
67	*h)*	156.375	156.375	x	x		
08		156.400		x			
68		156.425	156.425		x		
09	*i)*	156.450	156.450	x	x		
69		156.475	156.475	x	x		
10	*h)*	156.500	156.500	x	x		
70	*j)*	156.525	156.525	Digital selective calling for distress, safety and calling			

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		Ship stations	Coast stations		Single frequency	Two frequency	
11		156.550	156.550		x		
71		156.575	156.575		x		
12		156.600	156.600		x		
72	*i)*	156.625		x			
13	*k)*	156.650	156.650	x	x		
73	*h), i)*	156.675	156.675	x	x		
14		156.700	156.700		x		
74		156.725	156.725		x		
15	*g)*	156.750	156.750	x	x		
75	*n)*	156.775			x		
16		156.800	156.800	DISTRESS, SAFETY AND CALLING			
76	*n)*	156.825			x		
17	*g)*	156.850	156.850	x	x		
77		156.875		x			
18	*m)*	156.900	161.500		x	x	x
78		156.925	161.525			x	x
19		156.950	161.550			x	x
79		156.975	161.575			x	x
20		157.000	161.600			x	x
80		157.025	161.625			x	x
21		157.050	161.650			x	x
81		157.075	161.675			x	x
22	*m)*	157.100	161.700		x	x	x
82	*m), o)*	157.125	161.725		x	x	x
23	*m), o)*	157.150	161.750		x	x	x
83	*m), o)*	157.175	161.775		x	x	x
24	*m), o)*	157.200	161.800		x	x	x
84	*m), o)*	157.225	161.825		x	x	x

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public corres-pondence
		Ship stations	Coast stations		Single frequency	Two frequency	
25	*m), o)*	157.250	161.850		x	x	x
85	*m), o)*	157.275	161.875		x	x	x
26	*m), o)*	157.300	161.900		x	x	x
86	*m), o)*	157.325	161.925		x	x	x
27		157.350	161.950			x	x
87		157.375			x		
28		157.400	162.000			x	x
88		157.425			x		
AIS 1	*l)*	161.975	161.975				
AIS 2	*l)*	162.025	162.025				

Notes referring to the Table

Specific notes

MOD

m) These channels may be operated as single frequency channels, subject to special arrangement between interested or affected administrations.

ADD

o) These channels may be used to provide bands for initial testing and the possible future introduction of new technologies, subject to special arrangement between interested or affected administrations. Stations using these channels or bands for the testing and the possible future introduction of new technologies shall not cause harmful interference to, and shall not claim protection from, other stations operating in accordance with Article **S5**.

MOD

APPENDIX S27*

Frequency allotment Plan for the aeronautical mobile (R) service and related information

(See Article S43)

Section II – Allotment of frequencies in the aeronautical mobile (R) service

ARTICLE 1

Area	Frequency bands (MHz)										
	3	3.5	4.7	5.4 (Reg. 2)	5.6	6.6	9	10	11.3	13.3	18
	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz
2	2 938 2 950		4 696		5 556	6 583 6 601	8 846 8 855 8 888	10 015 10 045	11 297 11 360 11 390	13 321 13 357	17 964

ARTICLE 2

S27/222 Band 5 450-5 480 kHz (Reg. 2)5.4 MHz

Frequency (kHz)	Authorized area of use*	Remarks*
1	2	3
5 466	R 10B 13I	

MOD

APPENDIX S30*

Provisions for all services and associated Plans for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5 GHz (in Region 1) and 12.2-12.7 GHz (in Region 2)

MOD

ARTICLE 1

General definitions

1 For the purposes of this Appendix, the following terms shall have the meanings defined below:

1.1 *1977 Conference:* World Administrative Radio Conference for the Planning of the Broadcasting-Satellite Service in the Frequency Bands 11.7-12.2 GHz (in Regions 2 and 3) and 11.7-12.5 GHz (in Region 1), called in short World Broadcasting-Satellite Administrative Radio Conference (Geneva, 1977).

1.2 *1983 Conference:* Regional Administrative Radio Conference for the Planning in Region 2 of the Broadcasting-Satellite Service in the Frequency Band 12.2-12.7 GHz and Associated Feeder Links in the Frequency Band 17.3-17.8 GHz, called in short Regional Administrative Conference for the Planning of the Broadcasting-Satellite Service in Region 2 (RARC Sat-R2) (Geneva, 1983).

1.3 *1985 Conference:* First Session of the Word Administrative Radio Conference on the Use of the Geostationary-Satellite Orbit and the Planning of Space Services Utilizing It (Geneva, 1985), called in short WARC Orb-85.

1.3A *1997 Conference:* World Radiocommunication Conference (Geneva, 1997), called in short WRC-97.

1.3B *2000 Conference:* World Radiocommunication Conference (Istanbul, 2000), called in short WRC-2000.

1.4 *Regions 1 and 3 Plan*The Plan for the Broadcasting-Satellite Service in the Frequency Bands 11.7-12.2 GHz in Region 3 and 11.7-12.5 GHz in Region 1 contained in this Appendix.

ADD

* The expression "frequency assignment to a space station", wherever it appears in this Article, shall be understood to refer to a frequency assignment associated with a given orbital position. See also Annex 7 for the orbital limitations.

1.5 *Region 2 Plan:*The Plan for the Broadcasting-Satellite Service in the Frequency Band 12.2-12.7 GHz in Region 2 contained in this Appendix, together with any modifications resulting from the successful application of the procedures of Article 4 of this Appendix.

1.6 *Frequency assignment in conformity with the Plan:*

– Any frequency assignment which appears in the Regions 1 and 3 Plan: *or*

– Any frequency assignment which appears in the Region 2 Plan or for which the procedure of Article 4 of this Appendix has been successfully applied.

1.7 *Additional use in Regions 1 and 3:* For the application of the provisions of this Appendix, additional uses in Regions 1 and 3 are:

a) use of assignments with characteristics different from those appearing in the Regions 1 and 3 Plan and which are capable of causing more interference than the corresponding entries in the Plan;

b) use of assignments in addition to those appearing in the Plan.

1.8 *Regions 1 and 3 List of additional uses (hereafter called in short "the List"):* The list of assignments for additional uses in Regions 1 and 3 as established by WRC-2000, as updated following the successful application of the procedure of § 4.1 of Article 4 of this Appendix.

ARTICLE 2

Frequency bands

ADD

2.2 The use of the guardbands of the Plans in this Appendix, as defined in § 3.9 of Annex 5 to this Appendix, to provide space operations functions in accordance with No. **S1.23** in support of the operation of GSO BSS networks, shall be coordinated with the assignments subject to these Plans using the provisions of Article 7 of this Appendix. Coordination among assignments intended to provide these functions and services not subject to a Plan shall be effected using the provisions of No. **S9.7** and the associated provisions of Articles **S9** and **S11**. Coordination of modifications to the Region 2 Plan or assignments to be included in the Regions 1 and 3 List with assignments intended to provide these functions shall be effected using § 4.1.1 *e)*, 4.2.3 *e)* or 4.2.3 *f)* as appropriate, of Article 4 of this Appendix.

ARTICLE 3

Execution of the provisions and associated Plans

MOD

3.1 The Member States in Regions 1, 2 and 3 shall adopt, for their broadcasting-satellite space stations[1] operating in the frequency bands referred to in this Appendix, the characteristics specified in the appropriate Regional Plan and the associated provisions.

MOD

[1] Such stations may also be used for transmissions in the fixed-satellite service (space-to-Earth) in accordance with No. **S5.492**.

3.2 The Member States shall not change the characteristics specified in the Region 1 and Region 3 Plans or in the Region 2 Plan, or bring into use assignments to broadcasting-satellite space stations or to stations in the other services to which these frequency bands are allocated, except as provided for in the Radio Regulations and the appropriate Articles and Annexes of this Appendix.

ADD

3.3 The Plan for Regions 1 and 3 is based on national coverage from the geostationary-satellite orbit. The associated procedures contained in this Appendix are intended to promote long-term flexibility of the Plan and to avoid monopolization of the planned bands and orbit by a country or a group of countries.

MOD

ARTICLE 4

Procedures for modifications to the Region 2 Plan or for additional uses in Regions 1 and 3[2bis]

[2bis] The provisions of Resolution **49 (WRC-2000)** apply.

4.1 Provisions applicable to Regions 1 and 3

4.1.1 An administration proposing to include a new or modified assignment in the List shall seek the agreement of those administrations whose services are considered to be affected, i.e. administrations:

a) of Regions 1 and 3 having a frequency assignment to a space station in the broadcasting-satellite service which is included in the Regions 1 and 3 Plan with a necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment; *or*

b) of Regions 1 and 3 having a frequency assignment included in the List or for which complete Appendix **S4** information has been received by the Bureau in accordance with the provisions of § 4.1.3 of this Article, and any portion of which falls within the necessary bandwidth of the proposed assignment; *or*

c) of Region 2 having a frequency assignment to a space station in the broadcasting-satellite service which is in conformity with the Region 2 Plan, or in respect of which proposed modifications to that Plan have been received by the Bureau in accordance with the provisions of § 4.2.6 of this Article with a necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment; *or*

d) having no frequency assignment in the broadcasting-satellite service with a necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment, but in whose territory the power flux-density value exceeds the prescribed limit as a result of the proposed assignment, or having an assignment whose associated service area does not cover the whole of the territory of the administration, and in whose territory outside that service area the power flux-density from the proposed assignment exceeds the prescribed limit as a result of the proposed assignment; *or*

e) having a frequency assignment in the band 11.7-12.2 GHz in Region 2 or 12.2-12.5 GHz in Region 3 to a space station in the fixed-satellite service which is recorded in the Master International Frequency Register (Master Register) or for which complete coordination information has been received by the Bureau for coordination under No. **S9.7**, or under § 7.1 of this Appendix.

4.1.2 The services of an administration are considered to be affected when the limits shown in Annex 1 are exceeded.

4.1.3 An administration intending to include a new or modified assignment in the List shall send to the Bureau, not earlier than eight years but preferably not later than two years before the date on which the assignment is to be brought into use, the relevant information listed in Appendix **S4**. An assignment in the List shall lapse if it is not brought into use by that date.[4a]

4.1.4 If the information received by the Bureau under § 4.1.3 is found to be incomplete, the Bureau shall immediately seek from the administration concerned any clarification required and information not provided.

4.1.5 The Bureau shall determine, on the basis of Annex 1, the administrations whose frequency assignments are considered to be affected. The Bureau shall publish[3A], in a special section of its International Frequency Information Circular (IFIC), the complete information received under § 4.1.3, together with the names of the affected administrations, the corresponding FSS networks, the corresponding BSS assignments and terrestrial stations, as appropriate. The Bureau shall immediately send the results of its calculations to the administration proposing the assignment.

4.1.6 The Bureau shall send a telegram/fax to the administrations listed in the special section of the IFIC drawing their attention to the information it contains, and shall send them the results of its calculations.

4.1.7 An administration which considers that it should have been identified in the publication referred to under § 4.1.5 above shall, within four months of the date of publication of its relevant IFIC, and giving the technical reasons for so doing, request the Bureau to include its name in the publication. The Bureau shall study this information on the basis of Annex 1 and shall inform both administrations of its conclusions. Should the Bureau agree to the administration's request, it shall publish an addendum to the publication under § 4.1.5.

4.1.8 The administration seeking agreement or the administration with which agreement is sought may request any additional technical information it considers necessary. The administrations shall inform the Bureau of such requests.

[4a] The provisions of Resolution **533 (Rev.WRC-2000)** apply.

ADD [3A] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication, after informing the administration concerned. The Bureau shall inform all administrations of such action and that the network specified in the publication in question no longer has to be taken into consideration by the Bureau and other administrations. The Bureau shall send a reminder to the notifying administration, not later than 60 days prior to due date of the payment if payment has not been received by that date. This provision was identified in reply to Resolution 88 (Minneapolis, 1998) of the Plenipotentiary Conference and shall enter into force at a date to be determined by the forthcoming plenipotentiary conference.

4.1.9 Comments from administrations on the information published pursuant to § 4.1.5 should be sent either directly to the administration proposing the modification or through the Bureau. In any event, the Bureau shall be informed that comments have been made.

4.1.10 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of its IFIC referred to in § 4.1.5 shall be deemed to have agreed to the proposed assignment. This time-limit may be extended:

- for an administration that has requested additional information under § 4.1.8, by up to three months; or

- for an administration that has requested the assistance of the Bureau under § 4.1.21, by up to three months following the date at which the Bureau communicated the result of its action.

4.1.11 If, in seeking agreement, an administration modifies its initial proposal, it shall again apply the provisions of § 4.1 and the consequent procedure with respect to any other administration whose services might be affected as a result of modifications to the initial proposal.

4.1.12 If no comments have been received on the expiry of the periods specified in § 4.1.10, or if agreement has been reached with the administrations which have made comments and with which agreement is necessary, the administration proposing the new or modified assignment may continue with the appropriate procedure in Article 5, and shall so inform the Bureau, indicating the final characteristics of the frequency assignment together with the names of the administrations with which agreement has been reached.

4.1.13 The agreement of the administrations affected may also be obtained in accordance with this Article, for a specified period.

4.1.14 Where the proposed assignment involves developing countries, administrations shall seek all practicable solutions conducive to the economical development of the broadcasting-satellite systems of these countries.

4.1.15 The Bureau shall publish in a special section of its IFIC the information received under § 4.1.12, together with the names of any administrations with which the provisions of this Article have been successfully applied. The frequency assignment concerned shall be included in the List.

4.1.16 In case of disagreement on the part of an administration whose agreement has been sought, the requesting administration should first endeavour to solve the problem by exploring all possible means of meeting its requirement. If the problem still cannot be solved by such means, the administration whose agreement has been sought should endeavour to overcome the difficulties as far as possible, and shall state the technical reasons for any disagreement if the administration seeking the agreement requests it to do so.

4.1.17 If no agreement is reached between the administrations concerned, the Bureau shall carry out any study that may be requested by either one of these administrations; the Bureau shall inform them of the result of the study and shall make such recommendations as it may be able to offer for the solution of the problem.

4.1.18 If, in spite of the application of § 4.1.16 and 4.1.17, there is still continuing disagreement and the notifying administration insists that the proposed assignment be included in

the List, the Bureau shall enter the assignment provisionally in the List with an indication of those administrations whose assignments were the basis of the disagreement; however, the entry shall be changed from provisional to definitive recording in the List only if the Bureau is informed that the new assignment in the List has been in use, together with the assignment which was the basis for the disagreement, for at least four months without any complaint of harmful interference being made. When the assignment which was the basis of the disagreement is an assignment in the Plan, the second period of 15 years referred to in § 4.1.24 is subject to the written agreement of the administration concerned. Any action undertaken by WRC-03 to modify § 4.1.18 shall apply to all assignments entered provisionally in application of this provision between 3 June 2000 and the date of entry into force of the provisions of Appendices **S30** and **S30A**, as modified, if appropriate, by WRC-03. Without prejudice to any decision of WRC-03, the applications of § 4.1.18 in respect to a given assignment in the Plan shall be limited to three in the above period. The relevant studies requested by Resolution [GT PLEN-1/1] (WRC-2000) shall be carried out.

4.1.19 Should the assignments that were the basis of the disagreement not be brought into use within the period specified in No. **S11.44** (for non-planned services), or in § 4.1 (for assignments in the List or having initiated the procedure under § 4.1), as appropriate, then the status of the assignment in the List shall be reviewed accordingly.

4.1.20 Should harmful interference be caused by an assignment included in the List under § 4.1.18 to any recorded assignment in the Master Register which was the basis of the disagreement, the administration using the frequency assignment included in the List under § 4.1.18 shall, upon receipt of advice thereof, immediately eliminate this harmful interference.

4.1.21 An administration may, at any stage in the procedure described, or before applying it, request the assistance of the Bureau.

4.1.22 The relevant provisions of Article 5 of this Appendix shall be applied when frequency assignments are notified to the Bureau.

4.1.23 When a frequency assignment included in the List is no longer required, the administration concerned shall immediately so inform the Bureau. The Bureau shall publish this information in a special section of its IFIC and delete the assignment from the List.

4.1.24 No assignment in the List shall have a period of operation exceeding 15 years, counted from the date of bringing into use, or 2 June 2000, whichever is later. Upon request by the responsible administration received by the Bureau at the latest three years before the expiry of this period, this period may be extended by up to 15 years, on condition that all the characteristics of the assignment remain unchanged.

4.1.25 Where an administration already having included in the List two assignments (not including those systems notified on behalf of a group of named administrations and included in the List by WRC-2000), in the same channel and covering the same service area, proposes to include in the List a new assignment in the same channel over this same service area, it shall apply the following in respect of another administration which has no assignment in the List in the same channel and which proposes to include in the List a new assignment:

a) if the agreement of the former administration is required following the application of § 4.1 by the latter administration, in order to protect the new assignment proposed by the former administration from interference caused by the assignment proposed by the latter administration, both administrations shall make every possible effort to resolve the difficulties by means of mutually acceptable adjustments to their networks;

b) in case of continuing disagreement, and if the former administration has not communicated to the Bureau the information specified in Annex 2 to Resolution **49 (WRC-2000)**, this administration shall be deemed to have given its agreement to inclusion in the List of the assignment of the latter administration.

4.1.26 This procedure may be applied by the administration of a new ITU Member State in order to include new assignments in the List. Upon completion of the procedure, the next world radiocommunication conference may be requested to consider, among the assignments included in the List after the successful completion of this procedure, the inclusion in the Plan of up to 10 channels (for Region 1) and up to 12 channels (for Region 3), over the national territory of the new Member State.

4.1.27 When an administration has successfully applied this procedure and received all the agreements* required to include in the List assignments over its national territory, at an orbital location and/or in channels different from those appearing in the Plan for its country, it may request the next world radiocommunication conference to consider the inclusion in the Plan of up to 10 (for Region 1) and up to 12 (for Region 3) of these assignments, in replacement of its assignments appearing in the Plan.

4.1.28 The List, as updated, shall be published periodically by the Bureau.

4.1.29 New or modified assignments in the List shall be limited to digital modulation.

4.2 Provisions applicable to Region 2

4.2.1 When an administration intends to make a modification[5a] to the Region 2 Plan, i.e.:

a) to modify the characteristics of any of its frequency assignments to a space station in the broadcasting-satellite service which are shown in the Region 2 Plan, or for which the procedure in this Article has been successfully applied, whether or not the station has been brought into use; *or*

b) to include in the Region 2 Plan a new frequency assignment to a space station in the broadcasting-satellite service; *or*

c) to cancel a frequency assignment to a space station in the broadcasting-satellite service,

the following procedure shall be applied before any notification of the frequency assignment is made to the Radiocommunication Bureau (see Article 5 of this Appendix).

4.2.2 The term "frequency assignment in conformity with the Plan" used in this and the following Articles is defined in Article 1.

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* In such a case, § 4.1.18 does not apply.

[5a] For assignments using analogue modulation, the intention not to employ energy dispersal in accordance with § 3.18 of Annex 5 shall be treated as a modification and thus subject to the appropriate provisions of this Article.

4.2.3 An administration proposing a modification to the characteristics of a frequency assignment in conformity with the Region 2 Plan, or the inclusion of a new frequency assignment in that Plan, shall seek the agreement of those administrations:

a) of Regions 1 and 3 having a frequency assignment to a space station in the broadcasting-satellite service which is in conformity with the Regions 1 and 3 Plan with a necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment; *or*

b) of Regions 1 and 3 having a frequency assignment included in the List or for which complete Appendix **S4** information has been received by the Bureau in accordance with the provisions of § 4.1.3 of this Article, and any portion of which falls within the necessary bandwidth of the proposed assignment; *or*

c) of Region 2 having a frequency assignment in the Region 2 Plan to a space station in the broadcasting-satellite service in the same or adjacent channel which is in conformity with that Plan, or in respect of which proposed modifications to that Plan have been received by the Bureau in accordance with the provisions of § 4.2.6 of this Article; *or*

d) having no frequency assignment in the broadcasting-satellite service in the channel concerned, but in whose territory the power flux-density value exceeds the prescribed limit as a result of the proposed modification, or having an assignment whose associated service area does not cover the whole of the territory of the administration, and in whose territory outside that service area the power flux-density from the broadcasting-satellite space station subject to this modification exceeds the prescribed limit as a result of the proposed modification; *or*

e) having a frequency assignment in the band 12.5-12.7 GHz in Region 1 or 12.2-12.7 GHz in Region 3 to a space station in the fixed-satellite service which is recorded in the Master Register, or for which complete coordination information has been received by the Bureau for coordination under No. **S9.7** or under § 7.1 of this Appendix; *or*

f) having a frequency assignment to a space station in the broadcasting-satellite service in the band 12.5-12.7 GHz in Region 3 with a necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment, and:

i) which is recorded in the Master Register; *or*

ii) for which complete coordination information has been received by the Bureau for coordination under No. **S9.7**[7a] or under § 7.1 of this Appendix;

g) whose services are considered to be affected.

4.2.4 Not used.

4.2.5 The services of an administration are considered to be affected when the limits shown in Annex 1 are exceeded.

[7a] Or under Resolution **33 (Rev.WRC-97)** for assignments for which the API or the request for coordination has been received by the Bureau prior to 1 January 1999.

4.2.6 An administration intending to make a modification to the Region 2 Plan shall send to the Bureau, not earlier than eight years but preferably not later than two years before the date on which the assignment is to be brought into use, the relevant information listed in Appendix **S4**. Modifications to that Plan involving additions under § 4.2.1 *b)* shall lapse if the assignment is not brought into use by that date.

4.2.7 If the information received by the Bureau under § 4.2.6 is found to be incomplete, the Bureau shall immediately seek from the administration concerned any clarification required and information not provided.

4.2.8 The Bureau shall determine, on the basis of Annex 1, the administrations whose frequency assignments are considered to be affected within the meaning of § 4.2.3. The Bureau shall publish[3A], in a special section of its IFIC, the complete information received under § 4.2.6, together with the names of the affected administrations, FSS networks and BSS assignments, as appropriate. The Bureau shall immediately send the results of its calculations to the administration proposing the modification to the Region 2 Plan.

4.2.9 The Bureau shall send a telegram/fax to the administrations listed in the special section of its IFIC drawing their attention to the information it contains and shall send them the results of its calculations.

4.2.10 An administration which considers that it should have been included in the list of administrations whose services are considered to be affected may, giving the technical reasons for so doing, request the Bureau to include its name in the list. The Bureau shall study this request on the basis of Annex 1 and shall send a copy of the request, with an appropriate recommendation, to the administration proposing the modification to the Region 2 Plan.

4.2.11 Any modification to a frequency assignment which is in conformity with the Region 2 Plan or any inclusion in that Plan of a new frequency assignment which would have the effect of exceeding the limits specified in Annex 1 shall be subject to the agreement of all administrations whose services are considered to be affected.

4.2.12 The administration seeking agreement or the administration with which agreement is sought may request any additional technical information it considers necessary. The administrations shall inform the Bureau of such requests.

4.2.13 Comments from administrations on the information published pursuant to § 4.2.8 should be sent either directly to the administration proposing the modification or through the Bureau. In any event, the Bureau shall be informed that comments have been made.

ADD [3A] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication, after informing the administration concerned. The Bureau shall inform all administrations of such action and that the network specified in the publication in question no longer has to be taken into consideration by the Bureau and other administrations. The Bureau shall send a reminder to the notifying administration, not later than 60 days prior to due date of the payment if payment has not been received by that date. This provision was identified in reply to Resolution 88 (Minneapolis, 1998) of the Plenipotentiary Conference and shall enter into force at a date to be determined by the forthcoming plenipotentiary conference.

4.2.14 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the IFIC referred to in § 4.2.8 shall be deemed to have agreed to the proposed assignment. This time-limit may be extended by up to three months for an administration that has requested additional information under § 4.2.12 or for an administration that has requested the assistance of the Bureau under § 4.2.22. In the latter case, the Bureau shall inform the administrations concerned of this request.

4.2.15 If, in seeking agreement, an administration modifies its initial proposal, it shall again apply the provisions of § 4.2 and the consequent procedure with respect to any other administration whose services might be affected as a result of modifications to the initial proposal.

4.2.16 If no comments have been received on the expiry of the periods specified in § 4.2.14, or if agreement has been reached with the administrations which have made comments and with which agreement is necessary, the administration proposing the modification may continue with the appropriate procedure in Article 5 of this Appendix, and shall so inform the Bureau, indicating the final characteristics of the frequency assignment together with the names of the administrations with which agreement has been reached.

4.2.17 The agreement of the administrations affected may also be obtained in accordance with this Article, for a specified period.

4.2.18 When the proposed modification to the Region 2 Plan involves developing countries, administrations shall seek all practicable solutions conducive to the economical development of the broadcasting-satellite systems of these countries.

4.2.19 The Bureau shall publish in a special section of its IFIC the information received under § 4.2.16 together with the names of any administrations with which the provisions of this Article have been successfully applied. The frequency assignment concerned shall enjoy the same status as those appearing in the Region 2 Plan and will be considered as a frequency assignment in conformity with the Plan.

4.2.20 When an administration proposing to modify the characteristics of a frequency assignment or to make a new frequency assignment receives notice of disagreement on the part of an administration whose agreement it has sought, it should first endeavour to solve the problem by exploring all possible means of meeting its requirement. If the problem still cannot be solved by such means, the administration whose agreement has been sought should endeavour to overcome the difficulties as far as possible, and shall state the technical reasons for any disagreement if the administration seeking the agreement requests it to do so.

4.2.21 If no agreement is reached between the administrations concerned, the Bureau shall carry out any study that may be requested by these administrations; the Bureau shall inform them of the result of the study and shall make such recommendations as it may be able to offer for the solution of the problem.

4.2.22 An administration may at any stage in the procedure described, or before applying it, request the assistance of the Bureau.

4.2.23 The relevant provisions of Article 5 of this Appendix shall be applied when frequency assignments are notified to the Bureau.

4.2.24 Cancellation of frequency assignments

When a frequency assignment in conformity with Region 2 Plan is no longer required, whether or not as a result of a modification, the administration concerned shall immediately so inform the Bureau. The Bureau shall publish this information in a special section of its IFIC and delete the assignment from the Region 2 Plan.

4.2.25 Master copy of the Region 2 Plan

4.2.25.1 The Bureau shall maintain an up-to-date master copy of the Region 2 Plan, including the overall equivalent protection margins of each assignment, taking account of the application of the procedure set out in this Article. This master copy shall contain the overall equivalent protection margins derived from the Plan as established by the 1983 Conference and those derived from all modifications to the Plan as a result of the successful completion of the modification procedure set out in this Article.

4.2.25.2 An up-to-date version of the Region 2 Plan shall be published by the Secretary-General when justified by the circumstances.

ARTICLE 5

Notification, examination and recording in the Master International Frequency Register of frequency assignments to space stations in the broadcasting-satellite service

MOD

5.1.2 For any notification under § 5.1.1, an individual notice for each frequency assignment shall be drawn up as prescribed in Appendix **S4**, the various sections of which specify the basic characteristics to be provided as appropriate. It is recommended that the notifying administration should also supply any other data it may consider useful.

MOD

5.1.3 Each notice must reach the Bureau not earlier than three years before the date on which the frequency assignment is to be brought into use. In any case, the notice must reach the Bureau not later than three months before that date[4].

MOD

5.1.5 Any notice made under § 5.1.1 which does not contain the characteristics specified in Appendix **S4** shall be returned by the Bureau immediately by airmail to the notifying administration with the relevant reasons.

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[4] Where appropriate, the notifying administration shall initiate the procedure for modifying the Plan concerned or for including assignments in the Regions 1 and 3 List in sufficient time to ensure that this limit is observed. For Region 2, see also Resolution **42 (Rev.Orb-88)** and paragraph B of Annex 7.

MOD

5.1.6 Upon receipt of a complete notice, the Bureau shall include its particulars, with the date of receipt, in its International Frequency Information Circular (IFIC), which shall contain the particulars of all such notices received since the publication of the previous Circular.

MOD

5.2.1 The Bureau shall examine each notice:

a) with respect to its conformity with the Constitution, the Convention and the relevant provisions of the Radio Regulations (with the exception of those relating to § *b), c), d)* and *e)*below);

b) with respect to its conformity with the appropriate Regional Plan or the Regions 1 and 3 List, as appropriate; *or*

c) with respect to the coordination requirements specified in the remarks column of Article 10 or Article 11 of this Appendix; *or*

d) with respect to its conformity with the appropriate Regional Plan or the Regions 1 and 3 List, however, having characteristics differing from those in the appropriate Regional Plan or in the Regions 1 and 3 List, in one or more of the following aspects:

- use of a reduced e.i.r.p.,
- use of a reduced coverage area entirely situated within the coverage area appearing in the appropriate Regional Plan or in the Regions 1 and 3 List,
- use of other modulating signals in accordance with the provisions of § 3.1.3 of Annex 5,
- use of the assignment for transmission in the fixed-satellite service in accordance with No. **S5.492**,
- in the case of Region 2, use of an orbital position under the conditions specified in paragraph B of Annex 7; *or*

e) with respect to its conformity with the provisions of Resolution **42 (Rev.Orb-88)**.

MOD

5.2.2 Where the Bureau reaches a favourable finding with respect to § 5.2.1 *a)*, 5.2.1 *b)*and 5.2.1 *c)*, the frequency assignment of an administration shall be recorded in the Master Register. The date of receipt of the notice by the Bureau shall be entered in Column 2d. In relations between administrations, all frequency assignments brought into use in conformity with the appropriate Regional Plan and recorded in the Master Register shall be considered to have the same status irrespective of the dates entered in Column 2d for such frequency assignments.

MOD

5.2.2.1 Where the Bureau reaches a favourable finding with respect to § 5.2.1 *a)*, 5.2.1 *c)* and 5.2.1 *d)*, the frequency assignment shall be recorded in the Master Register. The date of receipt of the notice by the Bureau shall be entered in Column 2d. In relations between administrations, all frequency assignments brought into use in conformity with the appropriate Regional Plan and recorded in the Master Register shall be considered to have the same status irrespective of the dates entered in Column 2d for such frequency assignments. When recording these assignments, the Bureau shall indicate by an appropriate symbol the characteristics having a value different from that appearing in the appropriate Regional Plan.

MOD

5.2.2.2 Where the Bureau reaches a favourable finding with respect to § 5.2.1 *a)* and 5.2.1 *c)*, but an unfavourable finding with respect to § 5.2.1 *b)* and 5.2.1 *d)*, it shall examine the notice with respect to the successful application of the provisions of Resolution **42 (Rev.Orb-88)**. A frequency assignment for which the provisions of Resolution **42 (Rev.Orb-88)** have been successfully applied shall be recorded in the Master Register with an appropriate symbol to indicate its interim status. The date of receipt of the notice by the Bureau shall be entered in Column 2d. In relations between administrations all frequency assignments brought into use following the successful application of the provisions of Resolution **42 (Rev.Orb-88)** and recorded in the Master Register shall be considered to have the same status irrespective of the dates entered in Column 2d for such frequency assignments.

MOD

5.2.4 Where the Bureau reaches an unfavourable finding with respect to:

– § 5.2.1 *a)*, *or*

– § 5.2.1 *c)*, *or*

– §§ 5.2.1 *b)* and 5.2.1 *d)* and, where applicable, 5.2.1 *e)*,

the notice shall be returned immediately by airmail to the notifying administration with the reasons of the Bureau for this finding and with such suggestions as the Bureau may be able to offer with a view to a satisfactory solution of the problem.

MOD

5.2.9 The date in Column 2c shall be the date of bringing into use notified by the administration concerned.